

(RT042079) had a maximum value for total metals that was greater than total metal values at stations found in previous survey periods (2000-2002).

Stations where individual contaminant concentrations in fish tissue exceeded the 90<sup>th</sup> percentile for tissue contaminants in the 2000-2002 SCECAP data set were also evaluated to identify potentially contaminated habitats. The number of contaminants that exceeded the 90<sup>th</sup> percentile were counted at each station, and stations were ranked based on the number of exceedences. Due to changes in the method detection limits for PAHs, these contaminants were left out of this analysis. Exceedence values ranged from zero (no contaminants exceeded their respective 90<sup>th</sup> percentile value) to 14 exceedences at station RT042194 in the upper Ashley River. Of the six random stations that had 7 or more exceedences, four of the stations were in suburban or urbanized rivers: RO036054 in Winyah Bay, RT042194 and RT032046 in the Ashley River, and RO046087 in the Beaufort River. The distribution of contaminated fish tissue in 2003-2004 was similar to previous survey periods where the most highly contaminated fish were caught in suburban and urban rivers such as the Ashley River and the upper part of Winyah Bay.

### 3.5 Incidence of Litter

Solid waste products, or litter, represent an inevitable consequence of human presence in natural systems. As development and recreational and commercial activities continue to increase in South Carolina's coastal zone, the amount of litter entering our estuaries, flushing into the open ocean, and washing up on beaches is expected to increase.

During 2003 and 2004, litter was visible in 13% of the state's tidal creek habitat and 3% of state's open water habitat. This represented a decrease since the 2001-2002 survey period (during which 20% of tidal creek and 8% of open water habitat had litter), but litter remained elevated well above the 1999-2000 levels (2% of tidal creek and 3% of open water habitat). Generally, the greater percentages of tidal creek sites having litter relative to open water sites likely reflects the closer proximity of tidal creeks to human populations as well as the presence of shoreline, vegetation and oyster reefs that can retain

litter within the viewing distance of the survey crews. The reduction in litter over the previous survey period may reflect the flushing of litter out of our estuaries by increased freshwater inflow or just normal variability among survey periods. Considering the year-to-year variability, additional monitoring will be necessary to determine long term trends in litter.

### 3.6. Integrated Measures of South Carolina's Estuarine Habitat Quality

SCECAP is unique compared to most state and federal monitoring programs because it combines integrated measures of water quality, sediment quality, and biological condition into an overall measure of habitat quality at each site and for the entire coastal zone within its coverage area. Multi-metric measures provide a more reliable assessment than any single measure or group of measures representing only one component of the habitat. For example, poor or fair water quality based on state standards or historical data may not result in any clear evidence of impaired biotic communities. Many of South Carolina's state water quality standards are intentionally conservative to be protective and some contraventions of these standards are not severe enough to result in biological impairment. Similarly, fair or poor sediment quality may not result in degraded biotic condition because the organisms are either not directly exposed to the sediments (e.g., phytoplankton, fish) or because the contaminants are not readily bioavailable to the organisms. When two or more of the three measures (e.g., water quality, sediment quality, or biotic condition) are only fair or poor, there is increased certainty that the habitat may be limiting. While several studies have used a "triad" approach to measuring bottom sediment quality (e.g., Chapman, 1990; Chapman *et al.*, 1991), very few programs have been established elsewhere that use a more holistic approach that includes water quality variables. The USEPA National Coastal Assessment Program is the most successful federal program to use an approach similar to SCECAP, although the habitat metrics and method of integrating those metrics are very different (USEPA, 2001, 2004).

The overall index of habitat quality currently used by SCECAP is described by Van Dolah *et al.* (2004a, available online). This index weights each